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PHYSIOLOGIC RACES OF PUCCINIA GRAMINIS
IN THE UNITED STATES IN 1956

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THE PLANT DISEASE REPORTER

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Crops Research Division — Plant Industry Station, Beltsville, Maryland

PHYSIOLOGIC RACES OF PUCCINIA GRAMINIS IN THE UNITED STATES IN 1956[1, 2]

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Summary

Twenty-five races and subraces[6] of Puccinia graminis tritici were identified in 1,005 isolates from 686 uredial collections. Races 56 and 15B comprised 31 and 30 percent, respectively, of the isolates; the 17-29 race-group[7], 14 percent; race 11 (with 32), 13 percent; 38, 4 percent; 48A, 2 percent; 15, 1 percent. These races totaled 95 percent. The remaining 5 percent included 16 other races and subraces.

Four races were identified in 38 isolates from 25 collections of rusted wild barley made in Minnesota, North Dakota, and South Dakota. Race 15B was isolated more frequently than races 11, 56, or 38.

Seventeen races of wheat stem rust were isolated from 18 aecial collections. Races 56, the 17-29 race group, 11, 32, and 147 were isolated from two to four times each; other races once. Unusual races included 75, 118, 126, 142, and 147.

Certain varieties of wheat were found to be useful as supplemental differential varieties in distinguishing subraces. The varieties Triticum timopheevi, C.I. 3255, and N.D. 3 (C.I. 13159) differentiated four subraces of race 11; the first two, with Tremez Molle, differentiated four subraces of 15B; and C.I. 3255, N.D. 3, Towner, and R.L. 3206 differentiated five subraces of the 17-29 group.

Conley, Yuma, and Langdon were resistant in the seedling stage to subraces of race 11 at temperatures of 65°, 75°, and 85° F and mostly resistant to subraces of the 17-29 group at the same three temperatures.

From 408 collections of P. graminis avenae, race 7 comprised 66 percent of the 476 uredial isolates identified. Race 7A decreased from 4.5 percent in 1955 to 2 percent in 1956. Race 2 (with 5) comprised 17 percent of the isolates; race 8, 14 percent. Four races were identified in six aecial collections. One

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[1] Cooperative investigations of the United States Department of Agriculture and the Minnesota Agricultural Experiment Station. Paper No. 3753, Scientific Journal Series, Minnesota Agricultural Experiment Station.

[2] For summaries for the years 1939 through 1942, see 522 and 522A to C in the Bureau of Entomology and Plant Quarantine E-series; for 1943, 1944, 1945-49, and subsequent reports through 1953, see unnumbered publications in the Physiologic Races series; for 1954, see ARS-81-3; for 1955, see Plant Disease Reporter Supplement 239, July 15, 1956.

[3] Plant Pathologists, Plant Pest Control Division, Agricultural Research Service, United States Department of Agriculture.

[4] Agent, Crops Research Division, Agricultural Research Service, United States Department of Agriculture.

[5] E. C. Stakman continued leadership in the search for supplemental differential varieties and assisted in race identification at various times. Acknowledgment for collections is made to Donald G. Fletcher, of the Rust Prevention Association, and to members of the two Divisions and of the State Experiment Stations.

[6] A race comprises many subraces that may be distinguished from each other by different infection types on the standard differentials and/or supplemental varieties. The term biotype is restricted to cultures derived from single urediospores or aeciospores which may or may not be the same genotype as a subrace.

[7] Race-group is a term applied to closely related races that can be distinguished from each other only under certain environmental conditions.

of the isolates is a new subrace to which Bond is moderately resistant. This is the first indication, so far as known, that Bond has a gene or genes for resistance to stem rust.

PUCCINIA GRAMINIS TRITICI

In the United States, 25 races and subraces of P. graminis tritici were identified in 1,005 isolates from 686 uredial collections on wheat, barley, and grasses (Table 1). Races 56 and 15B were about equally prevalent, comprising 31 and 30 percent, respectively, of the total number of isolates. The 17-29 race group comprised 14 percent; race 11 and the closely related race 32, 13 percent; 38, 4 percent; 48A, 2 percent; race 15, 1 percent. These races totaled 95 percent. The remaining 5 percent included 16 other races, as follows: 1, 10, 14, 24, 31, 33, 34, 36, 48B, 59, 59A, 59B, 59C, 61, 133, and 147.

This was the first year since 1950 that race 15B has been equaled or surpassed in prevalence. When compared with the prevalence of races in 1955, 15B decreased 16 percent, whereas race 56 increased 12 percent. In 1953, when race 15B reached its peak with 63 percent of all isolates, race 56 comprised only 18 percent of the total (Fig. 1).

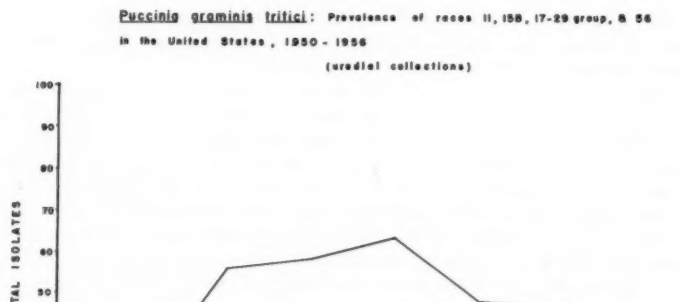

FIGURE 1

Race 11 increased from 2 percent in 1955 to 13 percent in 1956 and extended its geographic distribution from 9 States to 24. It comprised 17 percent of the total isolates from Minnesota, North Dakota, and South Dakota. It was found from California and Oregon eastward to Pennsylvania and from North Dakota south to Texas and eastward to Tennessee and Virginia. Race 11 also was isolated from barberry in Michigan, Pennsylvania, and Washington. This race is important because certain isolates are especially virulent on some of the Kenya wheats and their derivatives, used in breeding for rust resistance. Race 32, which is closely related to race 11, was found in California, Idaho, Michigan, Oregon, and Washington.

Race 15 increased in prevalence from 2 isolates in 1955 to 11 isolates, or 1.1 percent of the total, in 1956. There are indications that certain isolates of race 15 are more virulent than 15B on seedling plants of the new durums, Yuma and Langdon.

Subraces of the 17-29 group (mostly 29) decreased in prevalence from 20 percent in 1955 to 15 percent in 1956. The geographic range, however, increased from 21 States in 1955 to 26 in 1956. The races in the 17-29 group were fairly common in Texas, Illinois, Indiana, Ohio, and Pennsylvania but were found less frequently in other States from Oregon eastward to Pennsylvania and from North Dakota south to Oklahoma and eastward to Florida and South Carolina.

The new bread-wheat variety Selkirk, now rather widely grown in the spring-wheat area of the United States and Canada, is susceptible to certain isolates in this group.

Race 38 increased in prevalence from 2 percent in 1955 to 4 percent in 1956. It was collected four and five times in Pennsylvania and Ohio, respectively, and fewer times in other States.

Race 48A, which can cause heavy infection on Bowie, Selkirk, and Travis wheats, decreased in prevalence from 5 percent in 1955 to 2 percent in 1956. It was most common in Texas and was found once or twice in seven other States -- Idaho, Illinois, Ohio, Pennsylvania, South Dakota, Virginia, and Wisconsin.

Race 48B comprised 1 percent of the total isolates. It was collected five times in Oregon, less commonly in four other States. This subrace is differentiated from 48 and 48A on three of the standard differential varieties, as follows:

	Infection Types		
	Marquis	Reliance	Kota
48	1	0;[8]	1+
48A	2	0	2
48B	2	2	2

Race 56, with 31 percent of the isolates, was widely distributed in 27 of 33 States.

Because many wheat varieties now grown in the hard red spring-wheat area of Minnesota, North Dakota, and South Dakota are resistant to certain races, a special effort was made to identify collections from wild grasses, especially Hordeum jubatum, which apparently is susceptible to many races of stem rust. From 25 collections of stem rust on this grass from the three States, 38 isolates were identified. Race 15B comprised 45 percent of the isolates; race 11, 29 percent; race 56, 24 percent; and race 38, 2 percent. The only isolate of race 38 obtained from Minnesota in 1956 came from H. jubatum.

From 18 aecial collections from barberry, 28 isolates of wheat stem rust were identified, comprising 17 races (Table 2). Races 56, the 17-29 group, 11, and 32 were identified from several States; most of the other races were found only once. Unusual races included race 75, obtained from Berberis fendleri in southwestern Colorado. This race has been identified only twice during the past 18 years, both times from or near barberry in Washington. Other unusual races were 118 and 142 from Washington, 126 from Virginia, and 147, a race that attacks Vernal emmer, from Virginia and Iowa.

Beginning in 1954, special sets of wheat varieties additional to the standard differential varieties were inoculated with selected isolates of certain races of rust that are difficult to identify on the standard differentials even under different environmental conditions. Additional differentials were used in an attempt to obtain more precise information on some of the race-group complexes and to obtain varieties useful as supplemental differentials. In 1956, all rust isolates were tested on the 12 standard differentials plus Lee (C.I. 12488), Bowie (Texas Sel. 3708-22), Texas Sel. 131 (which is essentially the same as Bowie in rust reaction), Kenya Farmer (C.I. 12880), Selkirk (C.I. 13100), McMurachy (C.I. 11876), Kenya 360H (P.I. 177187) and Golden Ball (C.I. 5059). An additional 19 supplemental test varieties were inoculated with selected isolates of certain races. Following is the list of these varieties:

1. Triticum timopheevi

2. Common wheats
   - Frontana x (K58-Nwth) II-50-17 (C.I. 13154)
   - Gabo (C.I. 12795)
   - Kenya 117A (C.I. 12568)
   - Kenya 117A (Australia 1347)
   - Khapstein (Australia 1451)
   - Magnif G (Argentina, S.A.) (P.I. 197663)
   - Newthatch (C.I. 12318)
   - Conley (ND 1) (C.I. 13157)
   - N.D. 3

[8] 0; denotes hypersensitive necrotic flecks.

3. Durum wheats
   - C. I. 3255 (Spain)
   - C. I. 7905 (Ethiopia)
   - Yuma (Ld 364) (C. I. 13245)
   - Ramsey (Ld 369) (C. I. 13246)
   - Towner (Ld 370) (C. I. 13247)
   - Langdon (Ld 372) (C. I. 13165)
   - R. L. 3206 (C. I. 13141)
   - Sentry (Ld 356) (C. I. 13102)
   - Tremez Molle (Portugal)

During 1956, over 200 sets of supplemental test varieties, each comprising 19 wheats and Kindred barley, were inoculated with 20 selected races and subraces. Seedling plants were used in all of these studies. Some of the tests were made under controlled temperatures of 65°, 75°, and 85° F.[9] Following is a summary of results with respect to the most prevalent races and race groups.

Race 11 -- From 25 isolates tested, four subraces were differentiated on T. timopheevi, C. I. 3255, and N. D. 3 (C. I. 13159) at temperatures of 65°, 75°, and 85° F. Some subraces could be distinguished on certain varieties at 65° and 75°, others at 75° only, and one at 65° only. As an example of the influence of temperature on rust reaction, one of the subraces produced infection type 0; on Bowie wheat at 65°, type 2 at 75°, and type 4 at 85°. The other three subraces produced a range in type from 0; to 2 on Bowie at all three temperatures. The reaction of C. I. 3255 to all subraces was almost identical with that of R. L. 3206 and Golden Ball. Conley, Yuma, and Langdon were resistant to all subraces of race 11 at all temperatures at which they were tested. Selkirk and N. D. 3 were resistant to the four subraces at 65°, susceptible to some at 75°, and others at 85° only, as shown below.

	T. timopheevi		N.D.3 (C.I.13159)		C.I.3255		Bowie		
Subrace	65°	75°	65°	75°	65°	75°	65°	75°	85°
11A	1	0; 1	1-	2+	3	3±	0;	2≡	1-
11B	1	1	1+	3	3	3-	0;	1≡	2-
11C	0; 1	3 4	0	4	2-	2	0;	2-	3 4
11D	1	1-	1-	3 4	0;	3-	0;	2	2

Race 15B -- From 86 isolates tested, four subraces of 15B can be differentiated on T. timopheevi, C. I. 3255, and Tremez Molle at temperatures of 65° and 85° F. Golden Ball, C. I. 3255, and R. L. 3206 were similar in rust reaction to 80 isolates; they were resistant to about 35 percent and susceptible to 65 percent of the isolates. Conley, N. D. 3, and Towner were resistant to about 35 percent, moderately resistant to 12 percent, and susceptible to 53 percent of the isolates. Yuma and Langdon were resistant or moderately resistant to the 80 cultures to which they were tested. Selkirk was susceptible to all of the isolates.

Race 15 -- The supplemental test varieties were inoculated with eight isolates of this race. For the most part, the rust reactions of most varieties were similar to their reactions to isolates of 15B. However, Yuma and Langdon were susceptible to two isolates of race 15 which were collected in South Dakota in 1956.

Race 17-29 group -- From 41 isolates tested, five subraces of this race group were differentiated on N. D. 3, Towner, R. L. 3206, and C. I. 3255. Since no temperature control studies were made, it may not be possible to distinguish all subraces at all temperatures. The reaction of C. I. 3255, R. L. 3206, and Golden Ball to these subraces was very similar. The three varieties were resistant to 9 of the 28 isolates to which they were tested, or 31 percent, and susceptible to 19, or 69 percent. Conley, Yuma, and Langdon were mostly resistant. N. D. 3, Ramsey, and Towner were almost equally resistant to 14 cultures and susceptible to 14 but not always to the same isolates. Selkirk was moderately susceptible or susceptible to all samples tested.

[9] During the period from November 1, 1956, to February 15, 1957, when most of these studies were made, the standard deviations at the three temperature levels ranged from 1.7° to 3.1° F.

Race 56 -- All the supplemental test varieties were resistant to the eight isolates tested. The samples used in this study were obtained from various parts of the United States.

PUCCINIA GRAMINIS AVENAE

Race 7 of oat stem rust was the predominant race for the seventh consecutive year, although it decreased slightly in 1956, comprising 66 percent of the 476 uredial isolates identified. Race 7A, which can attack oat varieties with the so-called Canadian type of resistance, decreased from 4.5 percent in 1955 to 2 percent in 1956. Shifts in prevalence of other races also were slight. The race 2-5 group comprised 17 percent of the isolates, and race 8, 14 percent (Table 3).

The potentially dangerous race 6 was identified twice from New York and once from Missouri, and the closely related race 13 once from Maine. The identification of race 6 from Missouri is noteworthy, as this is the second time this race has been identified from rust collected outside of the northeastern States. It was first found in 1955 near Columbia, Missouri. In 1956 an isolate was collected in September on oats near Unionville. This may be further evidence that race 6 has extended its geographic range independent of barberry.

Four races of oat stem rust were identified from six aecial collections: 3, 5, 7, and an isolate tentatively identified as a subrace of race 1. The subrace of 1 was obtained from Michigan. Bond (C.I. 2733) is moderately resistant (infection type X-) to this culture, and the three regular differentials are highly resistant (0 and 0;). Nine of the supplemental varieties are resistant, but Clinton[2] X Ark. 674 (C.I. 6643) and Minnesota Selection 1953, II-47-11 are only moderately resistant (X-). Gopher (C.I. 2027) is susceptible (4) to this new subrace. The pathogenicity of this culture indicates for the first time, as far as is known, that Bond has some gene or genes for stem-rust resistance and may be useful as a supplemental differential variety. Gopher may be a more susceptible and suitable host on which to increase stem-rust cultures than Bond. Gopher, Bond, and Victory (C.I. 1145) -- the oat variety originally used by Stakman and Bailey[10] for increasing oat rust inoculum -- are therefore being evaluated as hosts at the Cooperative Rust Laboratory.

Race 3 was obtained from Pennsylvania and New York. This is the first time this race has been found in aecial or uredial collections in the past 18 years.

The same varieties or lines of oats used in 1954-55 were again added to the three standard differentials in all identifications made in 1956.

PLANT PEST CONTROL DIVISION AND CROPS RESEARCH DIVISION
AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE
IN COOPERATION WITH THE MINNESOTA AGRICULTURAL EXPERIMENT STATION
ST. PAUL, MINNESOTA

[10]Stakman, E. C. and D. L. Bailey. 1923. Biologic forms of Puccinia graminis on varieties of Avena spp. Jour. Agr. Res. 24: 1013-1017.

Table 1. Physiologic races of Puccinia graminis tritici isolated from uredial collections in the United States in 1956

State	Race and number of times isolated																								Total number of--		
	1	10	11	14	15	15B	24	17-29	29	31	32	33	34	36	38	48A	48B	56	59	59A	59B	59C	61	133	147	Isolates	Races	Collections
Alabama	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
California	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
Colorado	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	5	2	4
Florida	-	-	2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	10	3	5
Georgia	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	8	-	-	-	-	-	-	-	11	3	8
Idaho	-	2	8	-	-	-	-	1	4	2	3	-	-	1	3	1	2	5	-	-	-	2	-	1	-	35	13	25
Illinois	-	-	4	-	-	10	-	1	8	-	-	-	-	-	2	2	-	17	-	-	-	-	-	-	-	44	7	27
Indiana	-	-	5	-	-	5	-	9	4	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	35	5	23
Iowa	-	-	2	-	-	16	-	-	2	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	38	4	21
Kansas	-	-	2	-	-	8	-	1	1	-	-	-	1	-	2	-	1	8	-	-	-	-	-	-	-	24	8	15
Kentucky	-	-	2	-	-	1	-	2	2	-	-	-	-	-	2	-	-	10	-	-	-	-	-	-	-	19	6	12
Louisiana	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
Michigan	-	-	10	-	-	2	1	3	3	-	1	-	-	-	3	-	-	26	-	-	-	-	-	-	-	49	8	35
Minnesota	-	-	12	-	1	22	-	-	2	-	-	-	2	-	1	-	-	17	-	-	-	-	-	-	-	57	7	41
Missouri	-	-	3	-	1	10	-	4	2	-	-	-	-	-	2	-	-	16	-	-	-	-	-	-	-	38	7	25
Montana	-	-	1	-	-	5	-	1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	10	4	6
Nebraska	-	-	8	-	1	10	-	1	1	-	-	-	1	-	1	-	-	16	-	-	-	-	-	-	-	39	8	26
New Mexico	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
New York	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-	2	-	-	-	-	-	5	4	2
North Carolina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	1
North Dakota	-	-	16	-	5	62	-	3	1	-	-	-	1	-	1	-	-	6	-	-	-	-	-	-	-	95	8	79
Ohio	-	1	9	-	1	4	-	6	5	-	-	-	-	-	5	1	-	17	-	-	-	-	-	-	-	49	9	30
Oklahoma	-	-	7	-	-	7	-	2	1	-	-	-	-	-	1	-	-	5	-	-	-	-	-	-	-	23	6	14
Oregon	-	1	7	-	-	1	1	1	-	-	1	-	-	-	1	-	5	-	-	-	1	-	1	-	-	20	10	15
Pennsylvania	-	-	3	-	-	2	-	4	8	-	-	-	-	-	4	1	-	19	-	-	-	-	-	-	-	41	7	22
South Carolina	-	-	-	-	-	-	-	2	-	-	-	-	-	-	1	-	-	9	-	-	-	-	-	-	-	12	3	11
South Dakota	-	-	13	-	-	51	-	1	8	-	-	-	1	-	-	1	-	10	-	-	-	-	-	-	-	85	7	62
Tennessee	-	-	1	-	-	-	-	1	3	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	8	5	4
Texas	-	-	5	-	2	66	-	17	14	-	-	-	-	-	2	9	-	26	-	-	-	-	-	-	1	142	9	96
Virginia	-	-	1	1	-	2	-	-	7	-	-	1	-	-	3	2	-	24	2	2	-	-	-	-	-	45	10	30
Washington	2	1	-	-	-	1	1	1	-	-	1	-	-	-	1	-	1	-	-	-	-	1	-	-	-	10	9	7
West Virginia	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	1	1	-	-	-	-	13	4	11
Wisconsin	-	-	5	-	-	13	-	1	2	-	-	-	-	-	-	1	-	14	-	-	-	-	-	-	-	36	6	23
Totals	2	5	129	1	11	302	3	64	82	2	7	1	6	1	38	18	10	308	2	5	2	3	1	1	1	1,005	25	686
Percentage of isolates	0.2	0.5	12.8	0.1	1.1	30.1	0.3	6.3	8.1	0.2	0.7	0.1	0.6	0.1	3.8	1.8	1.0	30.7	0.2	0.5	0.2	0.3	0.1	0.1	0.1	100.0		

Table 2. Physiologic races of Puccinia graminis tritici isolated from aecial collections in the United States in 1956

State	Race and number of times isolated																		Total number of--		
	11	19	24	17-29	29	32	37	38	47	48A	56	59	75	118	126	142	147	Isolates	Races	Collections
Colorado	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1	1
Iowa	-	1	-	-	-	1	-	-	-	-	1	-	-	-	-	-	1	4	4	3
Michigan	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Pennsylvania	1	-	-	-	1	-	-	-	1	1	2	-	-	-	-	-	-	6	5	6
Virginia	-	1	-	1	-	-	1	-	-	-	1	-	-	-	1	-	1	6	6	3
Washington	1	-	1	-	1	1	-	-	-	-	-	1	-	1	-	1	-	7	7	2
Wisconsin	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	3	2	2
Totals	3	2	1	1	4	2	1	1	1	1	4	1	1	1	1	1	2	28	17	18
Percentage of isolates	10.7	7.1	3.6	3.6	14.2	7.1	3.6	3.6	3.6	3.6	14.2	3.6	3.6	3.6	3.6	3.6	7.1	100.0		

Table 3. Physiologic races of Puccinia graminis avenae isolated from uredial collections in the United States in 1956

State	Race and number of times isolated									Total number of--		
	2	5	6	7	7A	8	10	12	13	Isolates	Races	Collections
Alabama	-	-	-	1	-	-	-	-	-	1	1	1
Colorado	-	-	-	1	-	-	-	-	-	1	1	1
Florida	1	-	-	1	1	1	1	-	-	5	5	5
Georgia	1	-	-	2	1	-	-	-	-	4	3	3
Illinois	-	-	-	20	-	3	-	1	-	24	3	23
Indiana	-	-	-	17	1	-	-	-	-	18	2	17
Iowa	-	-	-	19	-	1	-	-	-	20	2	20
Kansas	-	1	-	10	-	2	-	-	-	13	3	11
Kentucky	-	2	-	5	-	-	-	-	-	7	2	5
Louisiana	-	2	-	-	-	-	-	-	-	2	1	2
Maine	-	-	-	-	-	-	-	-	1	1	1	1
Michigan	1	-	-	28	-	7	-	1	-	37	4	32
Minnesota	2	1	-	37	2	16	1	1	-	60	7	54
Mississippi	2	1	-	2	-	-	-	-	-	5	3	4
Missouri	4	5	1	17	-	12	1	-	-	40	6	35
Montana	-	-	-	-	-	1	-	-	-	1	1	1
Nebraska	3	1	-	5	-	-	-	-	-	9	3	6
New York[a]	1	-	2	2	-	-	-	-	-	5	3	5
North Dakota	-	-	-	24	-	6	-	-	-	30	2	24
Ohio	-	-	-	11	-	-	-	-	-	11	1	11
Oklahoma	2	-	-	3	-	1	-	-	-	6	3	5
Oregon	1	-	-	-	-	-	-	-	-	1	1	1
Pennsylvania[a]	1	-	-	33	-	-	-	-	-	34	2	34
South Dakota	-	-	-	17	-	5	-	-	-	22	2	21
Tennessee	7	-	-	7	-	-	-	-	-	14	2	8
Texas	16	14	-	24	2	2	-	-	-	58	5	40
Virginia	7	3[b]	-	8[c]	-	-	-	-	-	18	3	13
Wisconsin	-	-	-	18	1	8	1	-	-	28	4	24
Wyoming	-	-	-	-	-	1	-	-	-	1	1	1
Totals	49	30	3	312	8	66	4	3	1	476	9	408
Percentage of isolates	10.4	6.3	0.5	65.7	1.7	13.9	0.8	0.5	0.2	100.0		

[a] Race 3 isolated from 1 aecial collection.
[b] Isolated also from 2 aecial collections.
[c] Isolated also from 1 aecial collection.